

IN THE CLAIMS:

1 1. (Currently Amended) A method for programming a pattern matching engine
2 having a plurality of information storage entries with one or more regular expressions,
3 each regular expression including a plurality of characters and ~~having each regular ex-~~
4 ~~pression defining a corresponding action to be applied to~~ when matching strings are
5 found, the method comprising the steps of:
6 identifying one or more borders within a ~~given~~ regular expression, the one or
7 more borders separating the ~~given~~ regular expression into a plurality of sub-expressions,
8 at least one sub-expression having a plurality of sequential characters; and
9 loading one or more entries of the pattern matching engine with a plurality of the
10 sequential characters from ~~at least~~ more than one sub-expression, wherein the borders are
11 defined by a predetermined sequence of regular expression metacharacters, the entries
12 stored in content addressable memory (CAM) and
13 determining if the plurality of sequential characters from more than one sub-
14 expression matches a string, and if so, then
15 executing the corresponding action associated with that matched string.

1 2. (currently amended) The method of claim 1 wherein the predetermined se-
2 quence of regular expression metacharacters is a first regular expression metacharacter
3 defined to match any one character followed immediately by a second regular expression
4 metacharacter defined to match the ~~preceeding one~~ character zero, one, or more times.

1 3. (currently amended) The method of claim 1 further comprising ~~the a~~ step of or-
2 ganizing at least part of the pattern matching engine into a plurality of sections, and
3 wherein each section of the pattern matching engine is loaded with a plurality of search
4 patterns for a corresponding sub-expression.

1 4. (currently amended) The method of claim 3 wherein the entries of a ~~given~~-sec-
2 tion are loaded with a search pattern that includes a complete match of ~~the~~ a respective
3 sub-expression, a search pattern that includes a partial match of ~~the~~ a respective sub-
4 expression, and a mismatch pattern.

1 5. (currently amended) The method of claim 4 further comprising the steps of:
2 associating at least one sub-expression with a current state variable; and
3 loading the associated current state variable into each entry of ~~the~~ a section of the
4 pattern matching engine that contains the at least one sub-expression.

1 6. (Original) The method of claim 5 wherein the pattern matching engine has at
2 least one content addressable memory (CAM) loaded with the one or more regular ex-
3 pressions.

1 7. (currently amended) The method of claim 6 wherein
2 the CAM is a ternary content addressable memory, a TCAM, that supports don't
3 care values, and
4 each regular expressions loaded to the CAM ~~is loaded as~~ has a plurality of search
5 patterns including a mismatch pattern having ~~all~~-don't care values.

1 8. (currently amended) A method for programming a pattern matching engine
2 having a plurality of information storage entries with one or more regular expressions,
3 each regular expression including a plurality of characters and ~~having each regular ex-~~
4 pression defining a corresponding action to be applied ~~to~~ when matching strings are
5 found, the method comprising the steps of:

6 identifying one or more borders within a ~~given~~ regular expression, the one or
7 more borders separating the given regular expression into a plurality of sub-expressions
8 wherein at least one sub-expression has a plurality of sequential characters;

9 defining one or more search patterns for each sub-expression having one or more
10 borders containing a predetermined sequence of regular expression metacharacters, the
11 predetermined sequence of regular expression metacharacters containing a first regular
12 expression metacharacter defined to match any one character followed immediately by a
13 second regular expression metacharacter defined to match the ~~preceding one~~ character
14 zero, one, or more times;

15 including at the pattern matching engine at least one ternary content addressable
16 memory (TCAM) for loading one or more regular expressions and supporting don't care
17 values, and a second memory device having a plurality of entries for loading actions cor-
18 responding to the one or more regular expressions;

19 organizing at least part of the TCAM into a plurality of sections wherein each sec-
20 tion of the TCAM is loaded with a plurality of search patterns for a sub-expression, the
21 plurality of search patterns includes a complete match pattern of ~~the respective~~ a sub-
22 expression, a partial match pattern of the respective sub-expression, and a mismatch pat-
23 tern including ~~all~~ don't care values,

24 determining if the plurality of sequential characters from more than one sub-
25 expression matches a string, and if so, then
26 executing the corresponding action associated with that matched string.
27

1 9. (Original) The method of claim 8 wherein each entry of the TCAM identifies a
2 corresponding entry of the second memory device.

1 10. (currently amended) The method of claim 9 wherein at least one TCAM entry
2 is associated with a next state variable, the method further comprising the step of loading
3 ~~the~~ an entry of the second memory device that is identified by the at least one TCAM
4 entry with the associated next state variable.

1 11. (currently amended) The method of claim 10 wherein
2 the at least one TCAM entry is located in a TCAM section whose entries are as-
3 sociated with a current state variable having a first value, and
4 the next state variable has a second value that differs from the first value, ~~thereby~~
5 wherein the next state variable specifies ~~specifying~~ a new TCAM section to be searched.

1 12. (Original) The method of claim 11 wherein each TCAM entry has a match
2 cell that contains the complete match, the partial match or the mismatch pattern.

1 Claims 13-20. (Canceled)

1 21. (Previously Presented) The method of claim 1 wherein
2 each regular expression is associated with an action,
3 the pattern matching engine further includes a second memory device having a
4 plurality of entries, and
5 the entries of the second memory device are loaded with the actions associated
6 with the one or more regular expressions.

1 22. (currently amended) A method for programming a pattern matching engine
2 having a plurality of information storage entries with one or more regular expressions,
3 each regular expression including a plurality of characters and ~~having~~ each regular ex-

4 | pression defining a corresponding action to be applied to when matching strings are
5 | found, the method comprising the steps of:

6 | including at the pattern matching engine at least one ternary content addressable
7 | memory (TCAM) that supports don't care values, the TCAM loaded with the one or more
8 | regular expression; and

1 | including a second memory device having a plurality of entries for loading actions
2 | corresponding to the one or more regular expressions wherein each entry of the TCAM
3 | identifies a corresponding entry of the second memory device,

4 | determining that the plurality of sequential characters from more than one sub-
5 | expression matches a string, and

6 | executing the corresponding action associated with that matched string.
7 |

1 | 23. (Previously Presented) The method of claim 22 wherein at least one TCAM
2 | entry is associated with a next state variable, the method further comprising the step of
3 | loading the entry of the second memory device that is identified by the at least one
4 | TCAM entry with the associated next state variable.

1 | 24. (Previously Presented) The method of claim 23 wherein
2 | the at least one TCAM entry is located in a TCAM section whose entries are as-
3 | sociated with a current state variable having a first value, and
4 | the next state variable has a second value that differs from the first value, thereby
5 | specifying a new TCAM section to be searched.

1 | 25. (Previously Presented) The method of claim 24 wherein each TCAM entry
2 | has a match cell that contains the complete match, the partial match or the mismatch pat-
3 | tern.

26. (currently amended) ~~A switch~~Apparatus comprising:

means for programming a pattern matching engine having a plurality of information storage entries with one or more regular expressions, each regular expression including a plurality of characters and each regular expression defining a corresponding action to be applied when matching strings are found~~having a corresponding action to be applied to matching strings~~;

means for identifying one or more borders within a ~~given~~ regular expression, the one or more borders separating the given regular expression into a plurality of sub-expressions, at least one sub-expression having a plurality of sequential characters; and

means for loading one or more entries of the pattern matching engine with a plurality of the sequential characters from ~~at least~~more than one sub-expression, the entries stored in content addressable memory (CAM),

means for determining if the plurality of sequential characters from more than one sub-expression matches a string, and if so, then

means for executing the corresponding action associated with that matched string.

27. (currently amended) The ~~switch~~apparatus of claim 26, further comprising:

means for organizing at least part of the CAM into a plurality of sections, and wherein each section of the CAM is loaded with a plurality of search patterns for a corresponding sub-expression.

28. (currently amended) The ~~apparatus~~switch of claim 26, further comprising:

means for associating at least one sub-expression with a current state variable; and

means for loading the associated current state variable into each entry of the CAM that contains the at least one sub-expression.

1 | 29. (currently amended) The ~~apparatus~~switch of claim 26, further comprising:
2 | means for associating each regular expression with an action;
3 | means for including at the pattern matching engine a memory device having a
4 | plurality of entries;
5 | means for loading the memory device with the actions associated with the one or
6 | more regular expressions.

1 | 30. (currently amended) The ~~apparatus~~switch of claim 26, further comprising:
2 | means for using a ternary content addressable memory (TCAM) for the CAM,
3 | each entry of the TCAM identifying a corresponding entry of the memory device.

1 | 31. (currently amended) A ~~switch~~Apparatus comprising:
2 | a pattern matching engine having a plurality of information storage entries con-
3 | figured to program one or more regular expressions, each regular expression including a
4 | plurality of characters and having a corresponding action to be applied to matching
5 | strings;
6 | the pattern matching engine configured to identify one or more borders within a
7 | given regular expression, the one or more borders separating the given regular expression
8 | into a plurality of sub-expressions, at least one sub-expression having a plurality of se-
9 | quential characters; the pattern matching engine configured to determine that the plurality
10 | of sequential characters from more than one sub-expression matches a string, and if there
11 | is a matched string,
12 | then execute the corresponding action associated with that matched string, and
13 | a content addressable memory (CAM), the CAM configured to store a plurality of
14 | the sequential characters from at least one sub-expression.

1 | 32. (currently amended) The apparatus~~switch~~ of claim 31, further comprising:
2 | at least part of the CAM organized into a plurality of sections wherein each sec-
3 | tion is loaded with a plurality of search patterns for a corresponding sub-expression.

1 | 33. (currently amended) The apparatus~~switch~~ of claim 31, further comprising:
2 | the pattern matching engine configured to associate at least one sub-expression
3 | with a current state variable; and
4 | the pattern matching engine configured to store the associated current state vari-
5 | able into each CAM entry that contains the at least one sub-expression.

1 | 34. (currently amended) The apparatus~~switch~~ of claim 31, further comprising:
2 | a memory device having a plurality of entries;
3 | the memory device configured to store actions associated with the one or more
4 | regular expressions.

1 | 35. (currently amended) The ~~switch~~appartus of claim 31, further comprising:
2 | the CAM configured as a ternary content addressable memory (TCAM), the
3 | TCAM storing a corresponding entry for each entry of the second memory device.